Methyl parathion detection in vegetables and fruits using silver@graphene nanoribbons nanocomposite modified screen printed electrode

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We have developed a sensitive electrochemical sensor for Organophosphorus pesticide methyl parathion (MP) using silver particles supported graphene nanoribbons (Ag@GNRs). The Ag@GNRs nanocomposite was prepared through facile wet chemical strategy and characterized by TEM, EDX, XRD, Raman, UV-visible, electrochemical and impedance spectroscopies. The Ag@GNRs film modified screen printed carbon electrode (SPCE) delivers excellent electrocatalytic ability to the reduction of MP. The Ag@GNRs/SPCE detects sub-nanomolar concentrations of MP with excellent selectivity. The synergic effects between special electrocatalytic ability of Ag and excellent physicochemical properties of GNRs (large surface area, high conductivity, high area-normalized edge-plane structures and abundant catalytic sites) make the composite highly suitable for MP sensing. Most importantly, the method is successfully demonstrated in vegetables and fruits which revealed its potential real-time applicability in food analysis.

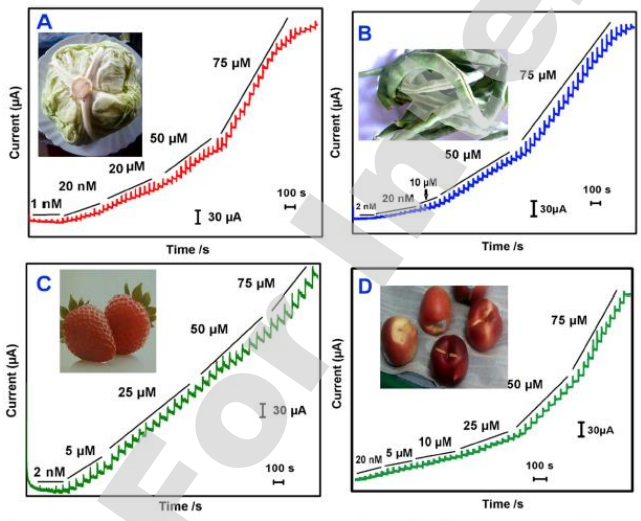
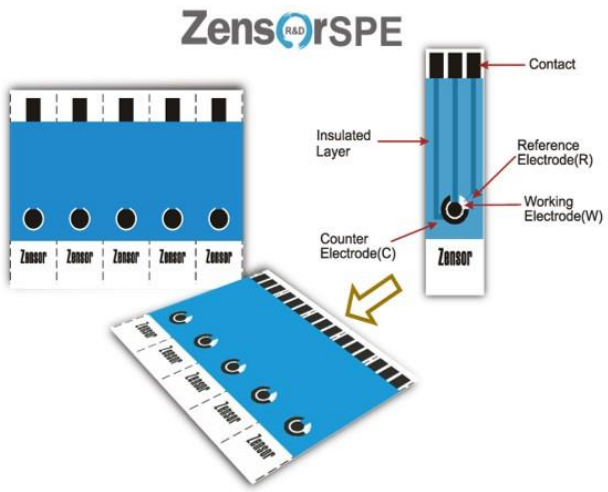


Figure 6. Real sample analysis: Amperometric responses of Ag@GNRs/SPCE for each sequential addition of real samples containing MP into continuously stirred phosphate buffer (pH 7). (A) cabbage, (B) Green beans, C) Strawberry and (D) nectarine fruit. Amperometric experiments are performed using Ag@GNRs/SPCE towards each sequential addition of real samples into phosphate buffer (pH 7). The rotation speed = 1500 RPM and electrode potential = −0.18 V.



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RSC Advances

Acetylcholinesterase biosensor based on the mesoporous carbon/ferroferric oxide modified electrode for detecting organophosphorus pesticides

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In this paper a biosensor modified by ordered mesoporous carbon–chitosan (OMC–CS)/ferroferric oxide–chitosan (Fe_3O_4–CS) was developed on the surface of screen-printed carbon electrodes (SPCEs). The acetylcholinesterase (AChE) was modified onto the film to prepare an AChE biosensor. Chitosan was used as a dispersant to disperse OMC and Fe_3O_4. The OMC and Fe_3O_4 were used to enhance the electrochemical response. Before the detection of organophosphorus (OP) pesticides, the electrochemical behaviour of AChE/OMC–CS/Fe_3O_4–CS/SPCE was studied with cyclic voltammetry, and the results showed that the chitosan can disperse OMC and Fe_3O_4 evenly and fix them on the electrode surface firmly. OMC and Fe_3O_4 have a significant synergistic effect towards electron transfer. The parameters affecting performance, such as the pH of the test solution, the amount of AChE and the time of inhibition have been optimized. Under optimum conditions, using methamidophos and chlorpyrifos as model compounds, this biosensor showed a wide range, low detection limit, good reproducibility and high stability. Moreover, the AChE/OMC–CS/Fe_3O_4–CS/SPCE biosensor can be used for the detection of real samples, and is suitable for field testing of OP pesticide residues.

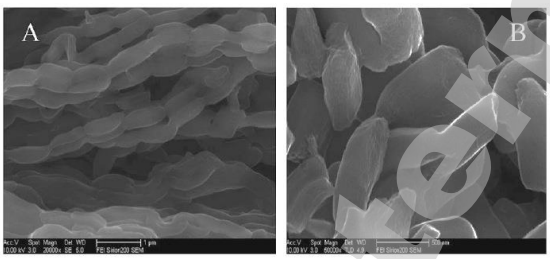


Fig. 1 SEM characterizations of OMC–CS (A) scale bar = 1 μm; (B) scale bar = 500 nm.

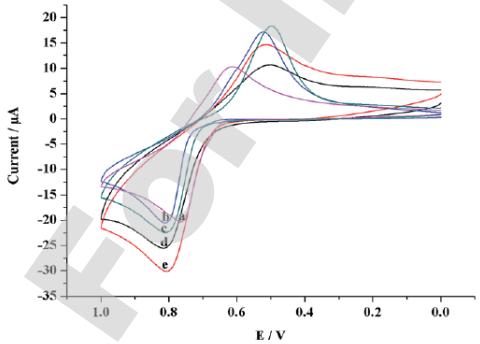


Fig. 3 CVs of modified SPCEs recorded in pH 7.5 PBS solution containing 1.0 mM ATCl: (a) bare SPCE; (b) Fe_3O_4–CS/SPCE; (c) OMC–CS/

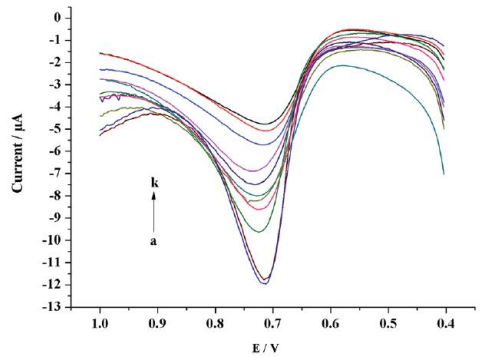
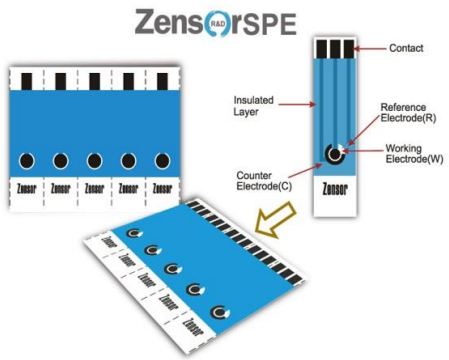


Fig. 7 DPV of AChE/OMC–CS/Fe_3O_4–CS/SPCE in pH 8.0 PBS solution containing 1.0 mM ATCl after inhibition with methamidophos for 12 min. Methamidophos concentration: (a–k) 0 μg L^{-1}; 1 μg L^{-1}; 10 μg L^{-1}; 20 μg L^{-1}; 30 μg L^{-1}; 40 μg L^{-1}; 50 μg L^{-1}; 100 μg L^{-1}; 200 μg L^{-1}; 400 μg L^{-1}; 600 μg L^{-1}.



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